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ARTIFICIAL INSEMINATION OF CHICKENS AND TURKEYS

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INTRODUCTION

The artificial insemination of chickens and turkeys was practiced on only a small scale and in an experimental way until 1936. Since that time it has been carried on much more extensively.

A method of obtaining semen, which was described by Burrows and Quinn (*2*) [1], and another method for inseminating the hen, described by Quinn and Burrows (*5*), have greatly simplified the process of artificially inseminating chickens and turkeys. Warren and Scott (*8*) in 1935 crossed chickens with turkeys by artificial insemination. They obtained fertile eggs from both the chicken and turkey hens, but most of the embryos died at an early age. No living offspring were obtained. Quinn, Burrows, and Byerly (*6*) also attempted the turkey-chicken and the chicken-turkey crosses with much the same results.

Sandnes and Landauer (*7*) reported that whereas spontaneous mating occurred between the male ring-necked pheasant and the domestic hen, the cross between the domestic cock and the female ring-necked pheasant seldom, if ever, occurred. By means of artificial insemination, they repeatedly obtained offspring from the latter cross. Marchlewski (*4*), by means of artificial insemination, crossed White Leghorn males with the guinea fowl. The eggs obtained were fertile, and the embryos began to hatch but did not live until they were fully hatched.

Burrows and Quinn (*3*) reported the results of experiments on the optimum quantities of semen to be used in the insemination of chickens, and Burrows and Marsden (*1*) reported work on the artificial insemination of turkeys.

Artificial insemination has been found to have the following advantages over natural mating:

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[1] Numbers in parentheses refer to Literature Cited, p. 12.

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1. The former method is the simplest and quickest means of fertilizing hens in laying batteries. Excellent fertility of the eggs of such hens has been obtained in both experimental and commercial practice.

2. In some matings in which fertility is low, it is possible to increase fertility by resorting to artificial insemination. In the mating of an old turkey tom with 10 hens, fertility increased from 7.5 to 88.4 percent when the natural mating was replaced by artificial insemination.

3. By the use of artificial insemination, the services of a valuable male may be greatly extended, for although natural mating may be very effective, it is now known that it is not so efficient as it might be.

The purpose of this circular is to present the available facts on the process of artificial insemination of chickens and turkeys and to mention the errors one is most likely to make during this procedure.

EQUIPMENT

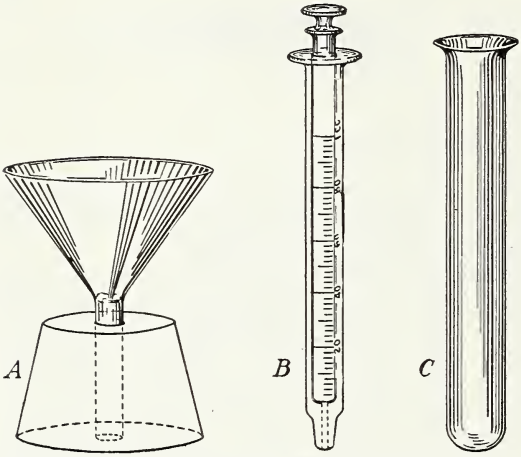

Figure 1.—Equipment for artificial insemination of chickens and turkeys: *A*, glass funnel about 2 inches wide at top, stem about 1½ inches long, plugged with paraffin, and inserted into a rubber stopper; *B*, tuberculin syringe of 1-cc. capacity; *C*, test tube of hard glass, one-half to three-fourths of an inch in diameter and about 4 inches long.

Equipment suitable for artificial insemination of chickens and turkeys is shown in figure 1.

Any small glass vessel that can be conveniently held in the hand may be used for collecting semen from the male bird. However, the small glass funnel, with its stem cut to about 1½ inches in length, plugged with paraffin, and thrust through a hole in a rubber stopper, has many advantages. It is easy to hold, its small apex is ideal for removing the last drop of semen with the syringe, and it is easily cleaned.

Any kind of container may be used for temporary storage of the semen, but a test tube one-half to three-fourths of an inch in diameter and 4 inches long has been found to be most suitable for this purpose. With such a tube, only a small area of semen is exposed to the air, resulting in little evaporation, and the contents at the bottom of the tube can be reached with the syringe for withdrawal. Hard glass is advisable but is not essential if the semen does not remain long in the tube. Spermatozoa appear to lose their motility faster when in contact with soft glass than with hard glass.

The syringe shown in figure 1 is the standard tuberculin syringe, which is also that used in the insulin treatment of diabetics. It has two sets of calibrations, one ranging from 0 to 16 minims and the other from 0 to 1 cc. in graduations of 0.01 cc. The latter calibration has been used for all the authors' measurements of semen in the artificial insemination of birds. The syringe is used without needles, both for transferring the semen of each male from the receptacle to the test tube and, later, from the test tube to the hen.

LEARNING TO INSEMINATE BIRDS ARTIFICIALLY

The artificial insemination of birds is a process the success and facility of which depend mostly on getting the knack of it. This statement applies particularly to obtaining semen from the male and, to a lesser degree, of exposing the oviducts of the females. It is easy for an experienced operator to train a new bird for these purposes. It is comparatively easy for an inexperienced operator to obtain results from a trained bird. However, much difficulty may be encountered when an inexperienced operator attempts to obtain results from an untrained bird. This difficulty is not insurmountable.

Three points of training must be kept in mind in practicing artificial insemination.

1. The bird should be held loosely, because gripping the legs rigidly blocks any attempt to stimulate the ejaculatory reflex.
2. The bird should be stimulated as soon as possible after being picked up, because a feeling of apprehension that apparently grows on the bird while it is being held makes it more and more difficult for the operator to obtain the desired reaction. This growing apprehension probably develops into a state of fear, but should not be confused with the startled condition that occurs when the bird is caught. The latter condition appears to aid, rather than hinder, the obtaining of the ejaculatory response. Thus, any attempt to soothe the bird before beginning stimulation is not a good practice.
3. Birds vary greatly in their reaction to stimulation. Some of them act almost like trained birds from the beginning.

In the event of failure to obtain semen or to expose the oviduct promptly, the bird should be released. Subsequent attempts may be made at 10- to 15-minute intervals. Any long-drawn attempt to stimulate a bird is practically useless. As many birds as possible should be handled in order to increase the chances of finding one that responds easily. The operator can then acquire the knack of stimulating the bird, after which he will be able to train those birds that do not respond readily.

OBTAINING SEMEN

Males, either chickens or turkeys, should be separated from females for 2 or more days before an attempt is made to collect semen. It is also advisable to keep the males separate to avoid the possibility of their treading one another, for when this happens collections are very unsatisfactory. It is easier to obtain semen from the males if a few feathers around the vent are plucked.

Holding the male is an important part of the procedure, for if the bird is improperly held any attempt to obtain semen may result in failure. The bird is held under the arm with a thigh in each hand, but as much as possible of its weight is supported by extending the fingers under its breast. Supporting the bird in this manner helps

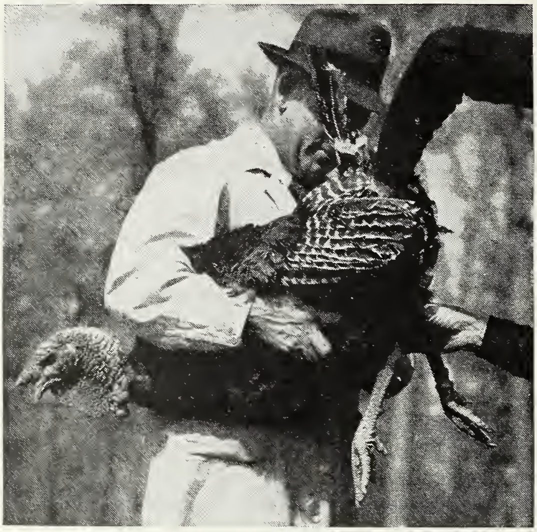

Figure 2.—Proper method of holding a turkey tom and its position during the process of obtaining semen. Roosters are held in the same manner.

to avoid gripping the thighs tightly, a practice that, as already stated, should always be avoided. Both the turkey and chickens are held in this way (fig. 2).

THE MALE ORGAN

In both chicken and turkey males, the copulatory organs ordinarily appear to be only folds of flabby tissue in the cloaca. However, during coplation they become distended and protrude from the cloaca.

The spermatozoa, which are developed in the testes, travel to the large, lower portion of the vas deferens, where they are temporarily stored. On sexual stimulation the bulbous ducts (shown by dotted lines, fig. 3)

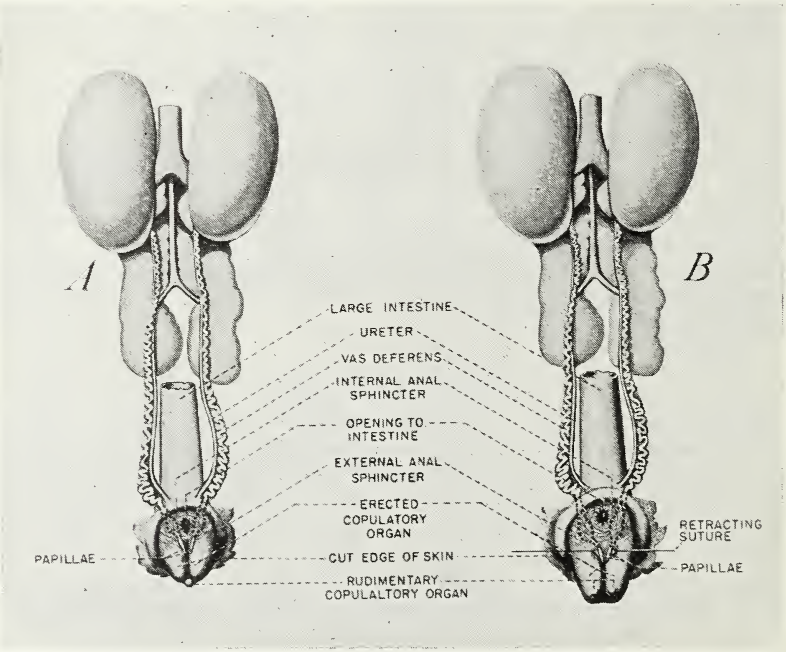

Figure 3.—Genital organs of the male chicken (*A*) and the turkey (*B*). The bulbous ducts are shown between the vasa deferentia and the papillae by dotted lines.

are filled. At ejaculation, the semen is expressed from the ducts through the tiny papillae.

The operator can obtain semen by stimulating the bird either to ejaculation or only enough to cause protrusion of the organ (fig. 4) and then squeezing the semen from the ducts. The latter, for reasons stated later, is the preferred method. However, even when the latter method is used, it is advisable to stimulate the bird to ejaculation after the semen has been squeezed from the ducts, for this operation refills the ducts, and the process can then be repeated until the available supply of semen has been exhausted.

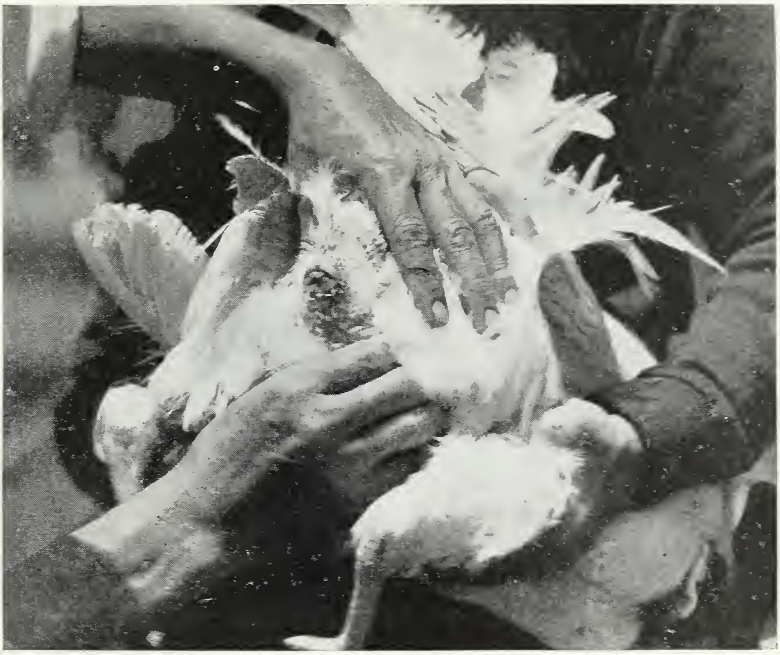

FIGURE 4.—Stimulating the male to protrude the copulatory organ.

STIMULATING THE BIRD

The male chicken can be stimulated to ejaculation by a light but rapid massage of the soft part of the abdomen just under the pelvic bones. However, in some males the response is more readily obtained if the process of massaging is gradually shifted to the lower part of the abdomen or even to the tip of the keel. Only a trial will determine what region is the most sensitive in any bird. The stimulation is always greatly aided by pushing the tail upward over the back with the other hand and by lightly stimulating the sides of the vent.

When the bird has been stimulated to protrude the copulatory organ, the operator, with the thumb and forefinger of the left hand, can take hold deeply in the soft part of the vent and squeeze the semen from the bulbous ducts (fig. 5).

Since the organ is often protruded and withdrawn rapidly, some practice may be necessary before the operator learns just when to close the thumb and forefinger. It is advisable to practice this operation a few times without any receptable to encumber the right hand until the technique is learned. Whenever possible, especially during the training period, the bird should be stimulated through a complete ejaculatory response because, besides acting to fill the bulbous ducts, it is an important part in the training and a great aid in obtaining future reactions. However, it may be impossible to stimulate some birds through a complete ejaculatory response, and semen must be obtained from such birds by repeating the partial stimulation and squeezing the semen from the ducts each time.

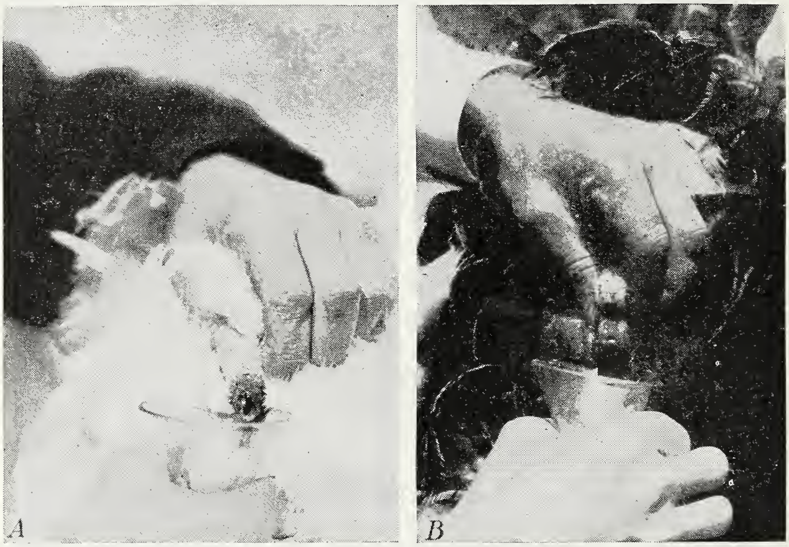

FIGURE 5.—Squeezing the semen from the bulbous ducts of chicken (*A*), and turkey (*B*).

With the turkey male, the technique is the same as that used with the chicken, except that it is inadvisable to stimulate the former through a complete ejaculatory response. It is possible to do this, but the process is too difficult to be of practical use and collections can be made from turkeys without so doing.

With both the chicken and the turkey, a considerable amount of defecation is almost sure to occur during the first few stimulations. When this occurs, it is almost impossible to obtain a clean sample of semen. After a few stimulations the tendency to defecate almost disappears. However, it may occur occasionally with any bird. For this reason the semen from each bird should be transferred from the receptacle to the test tube before proceeding to another male so that, in case of soiling, but one sample will be lost.

COLLECTIONS OF SEMEN

After the technique of stimulation has been mastered, the actual collection of semen can be made by holding the receptacle in the right hand (fig. 6) in such a manner that the thumb and some of the fingers are left free to massage the abdomen. The top of the funnel is tilted outward away from the bird while the stimulation takes place, thus reducing the chances of soiling the receptacle. Just before squeezing the semen from the ducts, the top of the funnel is tilted inward against the bird (fig. 5). It is then tilted outward during the next stimulation and back again during the next squeezing process. This operation is repeated until all the available semen has been obtained, usually from three to six times.

Semen may be collected from males as often as twice a day, but one collection a day will probably result in obtaining the maximum number of spermatozoa over a long period of time. The largest maximum quantity at one collection can be obtained by making collections once every 2 days, but when the interval between collections exceeds 2 days the quantity obtained usually is somewhat less than the maximum. For ease of operation, supply of semen, and collection of unsoiled samples, the results obtained are always much more satisfactory if collections are made regularly every 1 to 2 days.

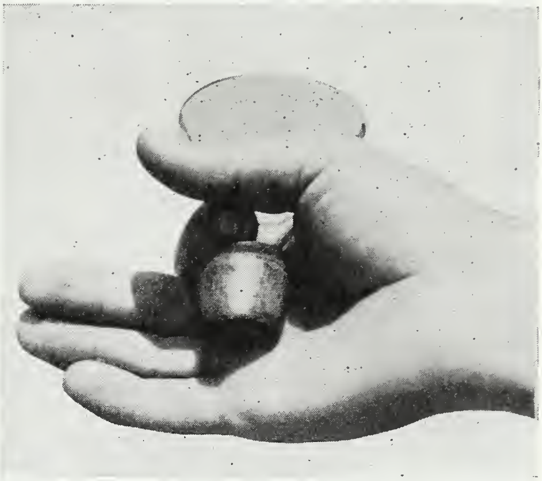

FIGURE 6.—Holding the container so that the fingers are free for stimulation purposes.

The average collection of semen from the male chicken amounts to about 1 cc. However, males have been observed from which no semen could be obtained, whereas others yield as much as 3 or 4 cc. at one time. The semen is usually white and thick but not sticky or stringy. The microscope shows that these white samples are very concentrated, containing millions of spermatozoa per cubic centimeter. Some males yield a slightly thinner specimen of semen, which is of a grayish color by comparison but which nevertheless contains millions of spermatozoa. An occasional male will produce a clear, watery fluid. This contains few spermatozoa and is not recommended for use.

The average quantity of semen obtainable at one collection from the turkey male is 0.3 to 0.4 cc. and the maximum about 1 cc. Semen of turkeys is thicker and more sticky than that of chickens. It is cream colored or yellowish in appearance and has a decided tendency to dry rapidly on exposure to the air. Because of this tendency and because of the small quantities collected, it is advisable to transfer the semen directly from the receptacle to the syringe, and when the syringe is full, from the syringe to the hen, eliminating the use of the test tube.

INSEMINATING THE HENS

No special preparations of the hens to be artificially inseminated are necessary, although for convenience they should be arranged in some way to facilitate handling. The insemination of hens is accomplished by (1) causing the oviduct to protrude from the vent and (2) inserting the end of the syringe into the oviduct and injecting the desired quantity of semen.

PROTRUDING THE OVIDUCT

During natural matings the hen protrudes the oviduct about one-half of an inch beyond the rim of the vent. Some hens protrude the oviduct spontaneously if they are picked up suddenly and their tails are pressed upward and over their backs. It is possible to maintain the oviduct in that position with a little pressure on the abdomen. Such pressure will also cause the protrusion of the oviduct of those hens that do not spontaneously protrude them, if their tails are at the same time forced upward and forward. In actual practice the hen is picked up, the hands are placed in position, and pressure applied without regard to any spontaneous protrusion of the oviduct.

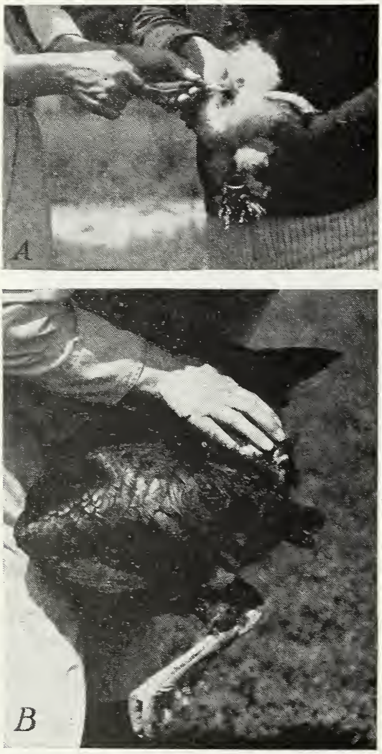

Figure 7.—Holding the hen for insemination: *A*, Chicken, and *B*, turkey.

The chicken is held in the left hand (fig. 7, *A*). The right hand is used to force the tail into position. The loose skin of the abdomen is gathered up in the finger tips of the left hand, making the abdomen taut, and then pressure is brought to bear by bringing the two hands together. It is the pressure between the hands, a compression between the keel and back of the bird, that actually effects the protrusion of the oviduct. This pressure should be applied suddenly and firmly for best results.

As in obtaining semen from the male, it has been found that protrusion of the oviduct can be accomplished more easily immediately after the hen has been picked up than if she has been held for some time. It is easier to cause protrusion of the oviducts of pullets than of old hens. It may be difficult to cause protrusion of the oviduct in extremely fat birds, and it is almost impossible in nonlaying hens and pullets. Laying pullets are recommended as being good material for practice.

The method of causing the oviduct of the turkey hen to protrude is similar to that of the chicken, except that, on account of the large size of the turkey hen, the bird's head is placed between the operator's legs, and its breast is supported on the sloping lap. With the bird in this position the legs are released in order to give the left hand more freedom in taking up the slack of the abdomen (fig. 7, *B*).

INTRODUCING THE SEMEN INTO THE OVIDUCT

With the oviduct of the hen (chicken or turkey) held in a protruded position, the syringe is inserted as far as it can be easily entered, usually about 1 inch (fig. 8). Then a constant, light, pushing pressure is maintained on the syringe while the pressure on the hen's abdomen is released, allowing the oviduct to return to its normal position. Unless this constant pressure on the syringe is maintained, the oviduct will often retract from the syringe, which will then be only within the cloaca. If any attempt is made to inject the semen while the oviduct is held in a protruded position, the internal pressure will force the semen out around the syringe and much semen will be lost outside the oviduct.

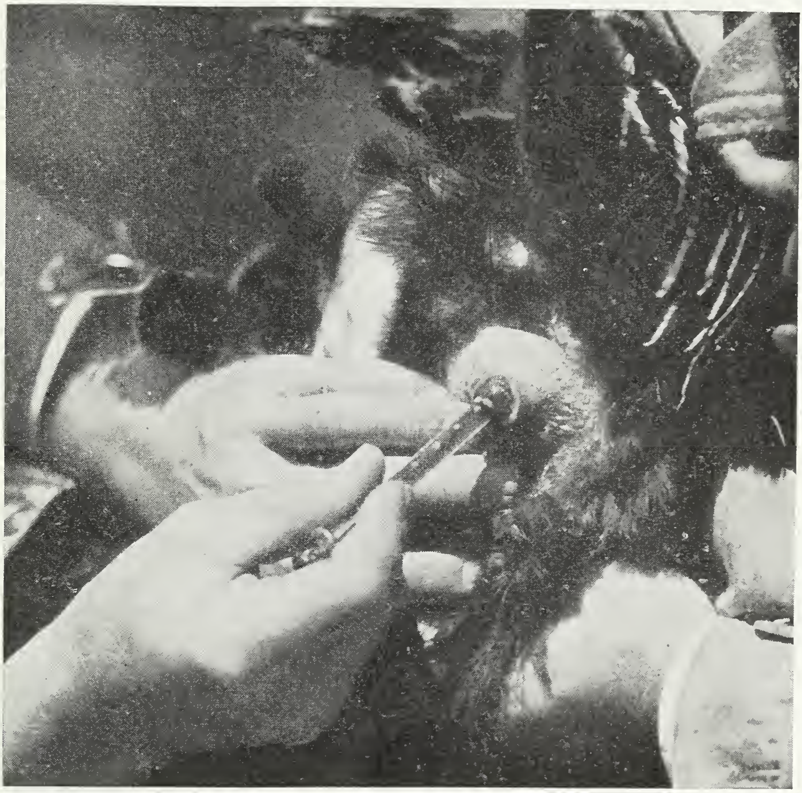

Figure 8.—The syringe is placed directly into the oviduct.

When the hen is relaxed and the syringe is in position to make the injection, about one-third of the syringe should be inside the cloaca and oviduct. Since about half of the calibrations are thus covered up, only four or five injections (usually 0.1 cc.) can be made without refilling the syringe. When it is desirable to use all the contents of the syringe before refilling, pencil calibrations can be made on the plunger of the syringe. However, these will rub off in a short time and must be renewed.

In making the calibrations on the plunger of the syringe, the syringe is filled with water to the 1-cc. mark and a pencil line drawn around the plunger where it emerges from the barrel. Then 0.05 or 0.1 cc. (depending on the dosage to be used) of water is pushed out of the syringe and another mark made. This operation is repeated until the syringe is empty. Injections can then be made according to the pencil marks, and the measurements will be accurate enough for all practical purposes.

TIME REQUIRED FOR COMPLETE OPERATION

Two trained operators have found it possible to collect semen from roosters at the rate of about one bird a minute and to inseminate chicken hens at the rate of about two birds a minute, including all the handling of the birds. The procedure can be carried out in this length of time when the males are kept in cages where they can be readily picked up, and the females are either in a laying battery or placed behind barriers in a laying house. With turkeys the time is about double that required for chickens because of the larger size of the birds and greater difficulty in handling.

DOSAGE OF SEMEN REQUIRED

In calculating the dosage of semen to be used in artificial breeding, it is always well to take into consideration the mating involved, for there are differences in the ease with which fertility can be produced in various matings. In some matings good fertility seems to be very easily obtained, whereas in others it is obtained only by using large doses of semen or frequent inseminations, or both.

The use of 0.1 cc. of semen once a week has been found to produce 80 to 95 percent of fertility in most of the matings that have thus far been studied. In some matings as little as 0.05 cc. once a week and 0.1 cc. only once in 10 days have been found to be sufficient to produce excellent fertility. In a few matings, high fertility was possible only when larger doses (0.2 cc.) and frequencies of three times a week were resorted to.

When it is desired to obtain as many chicks as possible from any one male, it is advisable to use only 0.02 cc. of semen per hen once a week. With this dosage, a relatively large number of eggs may be fertilized because many hens can be inseminated from the semen of one male and because the percentage of fertility does not fall off in proportion to the decrease in dosage. For instance, 1 cc. of semen a day will keep 350 hens fertilized when the dosage is 0.02 cc. once a week as against 70 hens with 0.1 cc. once a week, whereas the relation of fertility should be in the order of 50 and 85 percent, respectively.

All experimental work with turkey inseminations has been done with doses of 0.05 cc. of semen, and the indications are that this quantity is sufficient to give good results under most conditions. For unknown reasons some turkey hens fail to produce fertile eggs as the result of a single insemination. Therefore, it is advisable to inseminate two or three times at intervals of a day or two. As soon as a turkey hen begins to lay fertile eggs, a high rate of fertility usually persists for about 3 weeks, and in some birds as long as 4 weeks.

Some turkey hens fail to become fertile even with repeated and careful inseminations. This condition may be permanent, or it may be only temporary, in which case the hen may at some later time be readily fertilized.

The fertility of turkeys artificially inseminated, on experiment, has varied between 80 and 90 percent.

GENERAL OBSERVATIONS AND INSTRUCTIONS

In some males, a trace of blood may appear in the semen at the first one or two attempts to make collections. Although this tendency to bleed apparently does no permanent harm, it is well to handle such birds gently. After a few stimulations this tendency to bleed disappears, and these birds may be used regularly without any special care in operation.

A high rate of fertility does not always result from first attempts at artificial insemination, but in such cases experience has shown that failure to obtain high fertility is usually due to inattention to details. Most of the usual faults in technique are noted below in the order of likelihood of their occurrence.

1. The use of semen that is contaminated with foreign material. Any sample of semen that contains much clear, sticky fluid or that is discolored with fecal matter should not be used. It is not unusual to obtain a drop or two of clear, watery fluid after all the available semen has been obtained, but this fluid is not sticky. Such fluid comes from the bulbous ducts. It should be recognized as a sign that all available semen has been obtained and as a signal to cease efforts to obtain more. It is not harmful to the sample, except as it dilutes the concentration of the spermatozoa. On the contrary, urine or feces apparently do considerable damage to the fertilizing ability of the spermatozoa. Occasional white flecks of solid urates are almost impossible to avoid, and apparently these do no harm to the spermatozoa or to the hens.

2. Failure to get semen directly into the oviduct. In some birds a loose fold of tissue in the cloaca lies over the orifice of the oviduct unless the protrusion is quite complete. Further protrusion of the oviduct will result in complete exposure. Attempts to place the syringe under the edge of this fold will often result in failure to enter the oviduct. In such instances, the injection of semen will be only within the cloaca, and the fertility of that hen may be exceedingly low.

3. Poor fertility due to mating. With exactly the same care in inseminating, fertility may be low in one mating and high in another. It has been suggested that, in general, closely related birds may show better fertility than widely unrelated birds. Low fertility due to

incompatability of the mating can be somewhat overcome by more frequent inseminations and by large doses of semen (0.2 cc.). Doses larger than 0.2 cc. have not proved to be advantageous.

4. Poor fertility may occur because of deficiencies of the male when the semen from only one male is used. With a mixed sample of semen from several males the effects of weak spermatozoa from any one male are apparently overcome by the presence of a sufficient number of spermatozoa from other males. However, it is often desirable to breed from a single male. Since it appears that there are differences in the fertilizing ability of spermatozoa from different males, the dosage in such breeding work will depend on the results in each case. It does not follow, however, that the spermatozoa from a male that has shown poor fertility in normal matings will be low in ability to fertilize when used for artificial insemination. This fact was shown in the case of the turkey tom previously mentioned in which fertility was only 7.5 percent during natural mating and increased to 88.4 percent when artificial insemination was used.

Little research work has been done on the effects of nutrition on the semen production of males. Certainly a diet that will maintain the birds in good health is desirable. According to present knowledge, however, attempts to increase semen production by feeding massive quantities of vitamin concentrates may result in lowering production of semen rather than in increasing it.

SUMMARY

A technique for inseminating chickens and turkeys artificially is described and illustrated.

The technique can be easily learned if the instructions are closely followed. The equipment necessary for the procedure is relatively simple and inexpensive.

The technique provides a rapid and efficient means of obtaining fertile eggs from hens in laying batteries, of extending the usefulness of valuable males and females, and of effecting fertilization when birds do not, or cannot, mate naturally.

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